REMARKS

In response to the Appeal Brief previously filed by Applicants on November 19, 2007, the Examiner stated that Applicants' arguments were persuasive and reopened prosecution of the presently pending patent application. In the present Office Action, the Examiner maintained the previous grounds of rejection with regard to claims 1-24 and set forth a new ground of rejection with regard to claims 25-32. Claims 1-32 remain pending. Reconsideration and allowance of all pending claims are respectfully requested.

Amendments to the Drawings

As discussed above, the submitted replacement drawing sheet is provided to replace the original drawing sheet labeled "1/5." In particular, Applicants note that reference numeral 42 was used in Fig. 1 to reference both an electrical sensor and the box labeled "Non-electrical Motion Determination System." The attached replacement sheet correctly references the "Non-electrical Motion Determination System" via reference numeral 44. Applicants apologize for this minor error. Moreover, Applicants respectfully submit that this replacement sheet does not add any new matter and is fully supported by the specification. *See e.g.,* Application, page 12, lines 6-12.

Double-Patenting

In the Office Action, the Examiner provisionally rejected claims 1-16 on the ground of non-statutory obviousness-type double patenting as being unpatentable over claims 1-8 and 17-24 of copending Application No. 10/723,857. The Examiner also provisionally rejected claims 17-32 on the ground of non-statutory obviousness-type double patenting as being unpatentable over claims 17-32 of copending Application No. 10/723,857, in view of Rogers (US Patent No. 5,477,144). In view of the provisional nature of this rejection, no response is believed necessary at this time.

Claim Rejections Under 35 U.S.C. §102

In the Office Action, the Examiner rejected claims 1-8 under 35 U.S.C. §102(e) as being anticipated by Larson et al., U.S. Pending Publication No. 2004/0155653 A1 (hereafter "the Larson reference"). Applicants respectfully traverse these rejections.

Legal Precedent

Anticipation under Section 102 can be found only if a single reference shows exactly what is claimed. *See Titanium Metals Corp. v. Banner*, 227 U.S.P.Q. 773 (Fed. Cir.1985). For a prior art reference to anticipate under Section 102, every element of the claimed invention must be identically shown in a single reference. *See In re Bond*, 15 U.S.P.Q.2d 1566 (Fed. Cir.1990). That is, the prior art reference must show the *identical invention "in as complete detail as contained in the ... claim"* to support a *prima facie* case of anticipation. *Richardson v. Suzuki Motor Co.*, 9 U.S.P.Q. 2d 1913, 1920 (Fed. Cir. 1989) (emphasis added). Thus, for anticipation, the cited reference must not only disclose all of the recited features but must also disclose the *part-to-part relationships* between these features. *See Lindermann Maschinenfabrik GMBH v. American Hoist & Derrick*, 221 U.S.P.Q. 481, 486 (Fed. Cir.1984). Accordingly, the Applicants need only point to a single element or claimed relationship not found in the cited reference to demonstrate that the cited reference fails to anticipate the claimed subject matter. A *strict correspondence* between the claimed language and the cited reference must be established for a valid anticipation rejection.

Moreover, the Applicants submit that, during patent examination, the pending claims must be given an interpretation that is *reasonable* and *consistent* with the specification. *See In re Prater*, 162 U.S.P.Q. 541, 550-51 (C.C.P.A. 1969); *In re Morris*, 44 U.S.P.Q.2d 1023, 1027-28 (Fed. Cir. 1997); see also M.P.E.P. §2111 (describing the standards for claim interpretation during prosecution). Indeed, the *specification* is "the primary basis for construing the claims." *See Phillips v. AWH Corp.*, 415 F.3d 1303, 1315 (Fed. Cir. 2005). It is usually dispositive. *See id.* Interpretation of the claims must

also be consistent with the interpretation that those skilled in the art would reach. *See In re Cortright*, 49 U.S.P.Q.2d 1464, 1468 (Fed. Cir. 1999); *see also* M.P.E.P. §2111. That is, recitations of a claim must be read as they would be interpreted by those of ordinary skill in the art. *See Rexnord Corp. v. Laliram Corp.*, 60 U.S.P.Q.2d 1851, 1854 (Fed. Cir. 2001); *see also* M.P.E.P. §2111.01. In summary, an Examiner, during prosecution, must interpret a claim recitation as one of ordinary skill in the art would reasonably interpret the claim in view of the specification. *See In re American Academy of Science Tech Center,* 70 U.S.P.Q.2d 1827 (Fed. Cir. 2004).

Independent Claims 1-8

Independent claims 1-8 are directed towards various methods and systems, as well as computer readable media storing a computer program, all of which reflect various embodiments of the present invention. Applicants note, however, that claims 1-8 each commonly recite the acquisition of image data *and* the acquisition of motion data for *two or more organs* using *sensor-based* measurement systems, which may comprise either electrical or non-electrical sensors. Claims 1-8 further recite that two or more retrospective gating points *and* one or more motion compensation factors are *extracted from the motion data* acquired using the sensor-based systems. These features do not appear to be disclosed by the Larson reference.

Sensor-Based Acquisition of Motion Data for Two or More Organs

Applicants note that the Larson reference generally describes the use of image-based devices to derive motion data, specifically a magnetic resonance (MR) imaging device. *See* Larson, Abstract, paragraphs 10, 14, 25, and 35. The Larson reference also briefly mentions the use of an electrocardiogram (ECG – a well known type of sensor) for acquiring cardiac motion data. Although it is unclear as to whether the Larson reference purports to teach that the disclosed MR imaging device may be used for purposes other than cardiac imaging, even assuming that the Larson reference may disclose the imaging of other organs, Applicants note that the Larson reference would, at best, only disclose

that motion data for one organ (e.g., other than a heart) is acquired using an imaging device (MR imager), and that motion for a second organ (e.g., the heart) is acquired using a sensor (e.g. the ECG). It does not appear, however, that the Larson reference discloses motion data for *two* organs is acquired using *sensor-based* techniques.

In rejecting claims 1-8, however, the Examiner has persistently alleged that an MR imaging system constitutes a sensor. As Applicants have previously stressed, the present application draws a clear distinction between image-based and sensor-based systems for acquiring motion data and, therefore, one of ordinary skill in the art interpreting the claims in view of the present specification would not interpret the recited sensors to be the equivalent of an imaging system. For example, the present application *clearly* sets forth that motion data may be derived by using *either* an imaging system, such as an MR system, CT system, or X-ray system (e.g., by analyzing the image data itself in various domains) or, *alternatively*, by using a sensor-based system, which may include electrical sensors (*e.g.*, one or more ECGs, vector cardiography system) and/or non-electrical or mechanical sensors (*e.g.*, accelerometers, optical markers, displacement sensors, forced sensors, ultrasonic sensors, strain gauges, pressure sensors, and photodiodes), typically in the form of a pad or contact that may be disposed on the skin of a patient. *See* Application, page 10, line 21 to page 12, line 12. In other words, the specification clearly sets forth that the acquisition of motion data using sensor-based techniques is *distinct* from those that utilize the image data itself.

In view of the *clear* distinction between image-based and sensor-based techniques for measuring motion data, Applicants believe that the Examiner's interpretation in correlating the MR imager of Larson to the recited "electrical sensor" of the claims is not only unreasonable, but that the Examiner has misapplied long standing legal precedent stating that pending claims must be given an interpretation that is *reasonable* and *consistent* with the specification, and that the interpretation must be what those skilled in the art would reach. *See In re Prater*, 162 U.S.P.Q. 541, 550-51 (C.C.P.A. 1969); *In re*

Morris, 44 U.S.P.Q.2d 1023, 1027-28 (Fed. Cir. 1997); *see also In re Cortright*, 49 U.S.P.Q.2d 1464, 1468 (Fed. Cir. 1999); *see also* M.P.E.P. §2111. To the contrary, it appears the Examiner is implying that the specification should *not* be used in interpreting claim language, a view that is not only improper, but also in direct contrast with the established case law. For example, the Examiner, in responding to these points, has repeatedly suggested, erroneously, that reference to the specification in interpreting claim language constitutes improperly importing limitations from the specification into the claims. *See* Office Action, page 2; *see also* Final Office Action mailed 6/20/2007, page 2. In the present Office Action, the Examiner has specifically asserted a dictionary entry defining "sensor" as "a device that responds to a physical stimulus … and transmits a resulting impulse …" as being the broadest reasonable interpretation of this term. Office Action, page 2. Applicants submit that the Examiner's presumption that a dictionary definition is superior to the teachings of the specification itself is clearly misguided, improper and unreasonable in view of its open hostility to the teachings of the specification.

In particular, Applicants reemphasize that the Federal Circuit, sitting *en banc*, recently provided a summary and additional guidance regarding the proper interpretation of claims in view of the specification. *See Phillips v. AWH Corp.*, 75 U.S.P.Q.2d 1321 (Fed. Cir. 2005) (*en banc*). In *Phillips*, the Federal Circuit again emphasized the primacy of the specification in claim interpretation. Particularly, the *Phillips* court noted that the specification "is always highly relevant to the claim construction analysis. Usually, it is dispositive; *it is the single best guide to the meaning of a disputed term*." *Phillips*, 75 U.S.P.Q.2d at 1327 (quoting *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996)) (emphasis added). Moreover, the court also noted that:

> Ultimately, the interpretation to be given a term can only be determined and confirmed with a full understanding of what the inventors actually invented and intended to envelop with the claim. The construction that stays true to the claim language *and most naturally aligns with the patent's description of the invention* will be, in the end, the correct construction.

Phillips, 75 U.S.P.Q.2d at 1328-29 (quoting *Renishaw PLC v. Marposs Societa' per Azioni*, 158 F.3d 1243, 1250 (Fed. Cir. 1998)) (emphasis added).

With the foregoing and controlling case law in mind, the Applicants remind the Examiner that, as clearly set forth in the present application, the acquisition of motion data using sensor-based techniques is distinct from those techniques that utilize the image data itself. *See* Application, Figs. 1-2, page 10, line 21 to page 11, line 12 to page 15, line 9. In view of the clear distinction drawn between image-based and sensor-based techniques for measuring motion, as set forth in the specification, no reasonable construction of claims 1-8 based on the specification could interpret the recited sensor-based approaches to encompass techniques where motion data is acquired from the image data, as generally disclosed in the Larson reference. Certainly, the mere fact that an MR imaging system runs on electricity or the fact that an MR imaging system may be composed of a plurality of RF coils (which the Examiner erroneously argues as being sensors) for acquiring the imaging data does not make the MR imaging system an electrical sensor, as described in the cited passages of the application. Hence, no reasonable construction of the claim 1-8 could logically equate an MR imaging system, as disclosed in the Larson reference, with an electrical sensor as described in the present application. Indeed, the Examiner's assertion of such equivalence, in clear contrast to the plain teachings of the specification of the present application noted above, appears disingenuous.

This point is further evidenced by the plain language of the claims in question. For example, independent claims 1-8 each recite the acquisition of image data (or the means for acquiring such image data) as being separate from the acquisition of motion data by the recited electrical or non-electrical sensors. Claims 5 and 6 recite means for acquiring image data that are separate and distinct from the means for acquiring motion data. Claims 7 and 8 further recite an imager separately from a sensor-based motion measurement system. Indeed, the separate recitations of motion and image data (or, correspondingly, of sensor-based motion measurement systems and imagers) would appear to preclude interpreting an MR imaging system, as recited in the Larson reference, as acquiring motion data or of being the equivalent of a sensor-based motion measurement system.

Further, even assuming, *arguendo*, that the MR imager of Larson could constitute a sensor, the Examiner has still failed to properly correlate the recited "motion data" and "image data" of claims 1-8 to respective corresponding elements in the Larson reference. As discussed above, each of the claims recites the acquisition of image data as being *separate* from the acquisition of motion data. It is well established case law that for a prior art reference to anticipate under Section 102, every element of the claimed invention must be identically shown in a single reference. *See In re Bond*, 15 U.S.P.Q.2d 1566 (Fed. Cir.1990). Therefore, if the Examiner intends for the image data acquired by the MR imager of Larson to constitute as a sensor for acquiring motion data for one of the recited *two or more organs*, the Examiner would be unable use the MR imager to concurrently satisfy the step of "acquiring a set of image data," as is generally required by each of these claims

Extracting Retrospective Gating Points from the Motion Data Acquired via Sensors

Applicants further submit that the Larson reference does not appear to teach or suggest extracting two or more retrospective gating points based upon *motion* data acquired from sensors, as generally recited by each of the pending claims. Through out the prosecution of the present application, the Examiner has continually maintained that the Larson teaches the extraction of "timing information," which allegedly correspond to retrospective gating points. *See* Larson, paragraph 17. However, contrary to the recitations of claims 1-8, the disclosed "timing information" *is not extracted from motion data*.

The Larson reference is generally directed towards a technique for overcoming interference in ECG signals which may result from magnetic field interference when ECGs and MR imaging systems are used in conjunction with one another. In particular, the Larson reference discloses a technique which overcomes these drawbacks by acquiring timing signals *directly* from the image data itself. Paragraph 17 of the Larson reference notably summarizes a technique for extracting the above discussed "timing information" from k-space image data. *See generally,* Larson, paragraph 17. Specifically, the cited reference notes that "[t]he timing information may be extracted from a selected region of the low-resolution image." *Id.* It is this extracted timing information which may be used to subsequently retrospectively synchronize the MR imaging data with the motion of the target organ. *See* Larson, paragraph 19.

Therefore, even *if* the disclosed "timing information" could be interpreted as a "gating point," the Larson reference *clearly* states that the timing information is extracted from imaging data, *not* from motion data, as would be required to anticipate claims 1-8. Accordingly, the Examiner's Section 102 rejection of claims 1-8 is believed to be improper for this additional reason.

Motion Compensation Factors

Applicants further assert that the Larson reference fails to disclose extracting motion compensation factors, as recited by independent claims 1-8. Specifically, these claims recite extracting one or more motion compensation factors *from* the motion data acquired via the recited sensors, and processing image data based upon extracted motion compensation factors.

The present application describes that in addition to extracting gating points retrospectively from the sensor-acquired motion data, motion compensation factors may also be extracted. *See* Application, page 18, line 24 to page 19, line 3; *see also* FIG. 4. For example, motion compensation factors may include data predicting future motion by modeling anticipated motion either based on the acquired motion data or based on known a priori data about a moving organ. *See id.* The motion modeling may be accomplished by using both iterative (based directly on motion data) or non-iterative (based on a priori information) algorithms for optimizing criteria in both spatial and transform domains. *See id.* Further, the motion compensation factors may be extracted in addition to, or instead of, gating points. *See id.* at page 19, lines 5-24. In other words, the present application clearly describes motion compensation factors and gating points as being separate and distinct elements. While motion compensation factors are based on compensation of motion based on motion modeling algorithms, the gating points are derived based on intervals within a set multi-input motion data which correspond to an interval of little or no motion for an organ of interest. *See id.*

In the rejection of claims 1-8, the Examiner has attempted to correlate the recited motion compensation factors to "a peak, phase, or rate of a time-varying signal" which, according to the Larson reference, are extracted from the above discussed timing information. *See* Office Action, page 4. Specifically, the Examiner relies on paragraphs 18-19 of the Larson reference, which Applicants have reproduced below:

> [0018] The extracted timing information may be processed to provide temporal correspondence with the motion (e.g., a *time value* representing the time at which the motion begins or the time of another event during the motion). The processing may
> comprise extracting a peak, phase, or rate of a time-varying signal.
>
> [0019] The timing information may be used to retrospectively or prospectively synchronize the MR imaging data with the motion. The motion of the patient may be periodic (e.g., the periodic movement of the heart or lungs). The timing information may comprise a time-varying signal that varies in value over the period of the motion. The MR imaging data may be segmented cine imaging data.

Larson, page 2, paragraphs 18-19. (Emphasis added). These passages, however, appear to merely discuss the determination of timing intervals by assigning time values representing various points of time (e.g., corresponding to the above discussed peaks, phases, and rates of change) in the timing information which indicate to where motion begins to occur. The Larson reference further describes that the time intervals may be used to retrospectively synchronize the MR imaging data with the motion. *See* Larson, paragraphs 18-19. However, nothing in the reference appears to suggest that the peak, phase and rate of signal-change information is used to compensate for motion. Instead, the Larson reference, at best, appears to merely describe analyzing the timing information extracted from the MR imaging data to identify the peaks, phase, or rate of the time-varying signal, which may be used to align the MR imaging data with the motion of the organ of interest. Applicants remind the Examiner once again that pending claims must be given an interpretation that is *reasonable* and *consistent* with the specification. *See In re Prater*, 162 U.S.P.Q. 541, 550-51 (C.C.P.A. 1969); *In re Morris*, 44 U.S.P.Q.2d 1023, 1027-28 (Fed. Cir. 1997).

With this in mind, Applicants submit that the mere determination of peaks and phases of the timing signal extracted from the MR imaging data, as disclosed by Larson, does not appear to be consistent with the application's definition of extracting *motion compensation factors* which, as discussed above, may include data predicting future motion by modeling anticipated motion, either iteratively or non-iteratively, based on the acquired motion data or based on known a priori data about a moving organ. *See* Application, page 18, line 24 to page 19, line 3. The application further states that the motion compensation factors may be extracted in addition to or *instead of* the gating points. *See id.* This clearly indicates that the recited gating points and motion compensation factors are independent and separate from each other. However, as discussed above, the Examiner appears to have correlated the timing information (e.g., *from* which the peak, phase, and rate information is extracted) to the recited gating points. Thus, even assuming this correlation is correct, the disclosed peaks, phases, and rate of change of the timing signal could not be *independent* from the timing information since the Larson reference *clearly* indicates that they are derived *from* the timing information itself. Thus, it does not appear that peaks, phases, and rate information could reasonably constitute the recited motion compensation factors.

Still further, Applicants note that even if the peaks, phases, and rate of the time-varying signal information could be considered as motion compensation factors, claims 1-8 would still require that the motion compensation factors are extracted from the recited *motion data* which is acquired via the recited sensors. In stark contrast, the Larson reference makes it clear that this information is extracted *from the timing information* which, as discussed above, is *clearly* extracted from the *image data* acquired via the MR imager. Thus, contrary to the Examiner's assertions, these peaks, phase, and rate of change information are ultimately derived from the *image data* acquired via the MR imager of Larson, *not* motion data, as would be required to anticipate claims 1-8. Accordingly, Applicants submit that the Larson reference fails to disclose the recited motion compensation factors.

In view of the numerous deficiencies described above, among others, Applicants believe that the Larson reference clearly fails to disclose *all* the recited elements of independent claims 1-8. Accordingly, no *prima facie* case of anticipation is believed to exist with regard to independent claims 1-8 in view of the Larson reference. As such, Applicants respectfully request withdrawal of the rejection under Section 102 and allowance of claims 1-8.

Claim Rejections Under 35 U.S.C. §103

In the Final Office Action, the Examiner rejected claims 9-32 under 35 U.S.C. §103(a) as being unpatentable over the Larson reference in view of the Rogers reference. Applicants respectfully traverse this rejection.

Legal Precedent

The burden of establishing a *prima facie* case of obviousness falls on the Examiner. *Ex parte Wolters and Kuypers*, 214 U.S.P.Q. 735 (PTO Bd. App. 1979). The Examiner must not only show that the combination includes *all* of the claimed elements, but also a convincing line of reason as to why one of ordinary skill in the art would have found the claimed invention to have been obvious in light of the teachings of the references. *Ex parte Clapp*, 227 U.S.P.Q. 972 (B.P.A.I. 1985). In addressing obviousness determinations under 35 U.S.C. §103, the Supreme Court in *KSR International Co. v. Teleflex Inc.*, No. 04-1350 (April 30, 2007), reaffirmed many of its precedents relating to obviousness including its holding in *Graham v. John Deere Co.*, 383 U.S. 1 (1966). In *KSR*, the Court also reaffirmed that "a patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art." *Id.* at 14. In this regard, the *KSR* court stated that "it can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does … because inventions in most, if not all, instances rely upon building blocks long

since uncovered, and claimed discoveries almost of necessity will be combinations of what, in some sense, is already known." *Id.* at 14-15. In *KSR*, the court noted that the demonstration of a teaching, suggestion, or motivation to combine provides a "helpful insight" in determining whether claimed subject matter is obvious. *KSR, slip op.* at 14.

Further, when prior art references require a selected combination to render obvious a subsequent invention, there must be some reason for the combination other than the hindsight gained from the invention itself, i.e., something in the prior art as a whole must suggest the desirability, and thus the obviousness, of making the combination. *Uniroyal Inc. v. Rudkin-Wiley Corp.*, 837 F.2d 1044, 5 U.S.P.Q.2d 1434 (Fed. Cir. 1988). One cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention. *In re Fine*, 837 F.2d 1071, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988). The Federal Circuit has warned that the Examiner must not, "fall victim to the insidious effect of a hindsight syndrome wherein that which only the inventor taught is used against its teacher." *In re Dembiczak*, F.3d 994, 999, 50 U.S.P.Q.2d 52 (Fed. Cir. 1999) (quoting *W.L. Gore & Assoc., Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1553, 220 U.S.P.Q. 303, 313 (Fed. Cir. 1983)).

Claims 9-16

Independent claims 9-16 are directed towards various methods and systems, as well as computer readable media storing a computer program, all of which reflect various embodiments of the present invention. Applicants note, however, that claims 9-16 each commonly recite the acquisition of image data *and* the acquisition of motion data for *a respiratory organ* (e.g., a lung) using both electrical *and* non-electrical *sensor-based* measurement systems. Applicants respectfully submit that the Larson and Rogers references, alone or in combination, do not appear to teach or suggest this feature.

As discussed above, the Larson reference generally discloses the use of an MR imager for acquiring *image data*. In view of Applicants' above discussion, an MR imager could not be reasonably construed as a sensor. Instead, the *only* sensor-based measurement system disclosed in the Larson reference appears to be an ECG for measuring cardiac data for a heart, which clearly does not qualify as a respiratory organ. *See* Larson, paragraph 63. Moreover, while the Rogers reference, which the Examiner cited in combination with Larson, does appear to discuss the use of pressure transducers, acoustic microphones, piezoelectric crystal transducers, strain gauges, and air flow meters for measuring cardiac or respiratory motion, Applicants note that these devices are all *non-electrical* sensors. *See* Rogers, col. 5, lines 53-63. That is the underlying phenomena (pressure, acoustics, strain, air flow) measured by such devices are all *non-electrical* in nature, a fact readily acknowledged by the Examiner. *See* Final Office Action mailed 6/20/2007, page 7, lines 7-8 (the Examiner stating that a pressure transducer, acoustic microphone, and piezoelectric crystal transducer are all non-electrical devices).

The Rogers reference does briefly mention that an RF-coil may be used for acquiring respiratory motion data. *See* Rogers, col. 5, lines 59-61. Although an RF coil may be regarded as electrical in nature, Applicants submit that it is well known in the art that an RF coil is a component of an MR imaging device. Indeed, the Rogers reference clearly states that the RF coils are being discussed in the context of "[p]hysiological processes that would be suitable for synchronization by an MRI scanner." Rogers, col. 5, lines 49-65. In other words, an RF coil is merely a component of an MR imaging system which is used to acquire imaging information. However, given the proper claim interpretation discussed above with regard to claims 1-8, the RF coil is still part of an *image-based* device for acquiring the respiratory data, *not* a sensor-based device as suggested by the Examiner. That is, the Examiner cannot simply point to a component of the MR imager to satisfy the recited electrical sensor of claims 9-16 when the plain language of the claims recites the imager and the sensor as *separate* structures.

Accordingly, Applicants submit that the combination of the Larson and Rogers references, at best, *only* disclose the use of *non-electrical* sensors for acquiring respiratory motion data. For at least this reason, the Larson and Rogers references, taken alone or in combination, cannot render obvious claims 9-16.

Claims 17-24

Independent claims 17-24 are directed towards various methods and systems, as well as computer readable media storing a computer program, all of which reflect various embodiments of the present invention. Applicants note, however, that claims 17-24 each commonly recite the concurrent acquisition of *cardiac motion data* via at least one *non-electrical sensor* and *respiratory motion data* via at least one *non-electrical or electrical sensor*. Applicants respectfully submit that the Larson and Rogers references, alone or in combination, do not appear to teach or suggest this feature.

As discussed above with regard to independent claims 1-8, the *only* sensor disclosed by the Larson reference is an ECG for measuring cardiac data. As the Examiner will appreciate, an ECG is a well known *electrical* sensor. In an attempt to remedy this deficiency of the Larson reference, the Examiner further relies on the Rogers reference which, as discussed above, does appear to contemplate the use of non-electrical sensors for acquiring cardiac data. Specifically, the Examiner alleged that a person skilled in the art would find such a combination desirable "because it avoids the problem of interference between the [electrical] cardiac motion sensors and the magnetic field of the MR imaging system." Office Action, page 5. Applicants respectfully disagree. Instead, the Examiner's proposed combination of these references appears to be based on impermissible hindsight, which is insufficient to support a *prima facie* obviousness rejection. That is, when prior art references require a selected combination to render obvious a subsequent invention, there must be some reason for the combination other than the hindsight gained from the invention itself, i.e., something in the prior art as a

whole must suggest the desirability, and thus the obviousness, of making the combination. *Uniroyal Inc. v. Rudkin-Wiley Corp.*, 837 F.2d 1044, 5 U.S.P.Q.2d 1434 (Fed. Cir. 1988).

With the foregoing in mind, Applicants respectfully submit that a person skilled in the art considering these two references would *not* find it obvious to replace the *electrical sensor* (e.g., ECG) of the Larson reference with any of the *non-electrical sensors* (e.g., pressure transducer, acoustic microphone, etc.) disclosed by the Rogers reference. As discussed above, the Larson reference is generally concerned with the synchronization of MR imaging data to a set of motion data. *See* Larson, paragraph 1. In accordance with prior art techniques, motion data, such as that acquired via an ECG, is typically acquired concurrently with the MR imaging data. *See id.* at paragraph 3. However, such a technique is not without drawbacks. For instance, one of the problems addressed in the teachings of the Larson reference is with regard to the interference faced by ECG devices when used in conjunction with magnetic fields generated by MR imaging systems. *See* Larson, page 3. Such interference may render it necessary during MR imaging to relocate the electrodes on a patient's body in order to acquire a viable ECG signal. *See id.* Undesirably, this typically requires that MR image acquisition be stopped, and the patient withdrawn from the bore of the MR unit. *See id.* To address this drawback, the Larson reference offers a solution in which the use of sensors for acquiring motion data is completely obviated. Specifically, Larson offers a technique in which the desired motion data is extracted directly *from the image data itself*, such as via analyzing raw k-space or transformed k-space data. *See id.* at paragraph 17. For instance, Larson teaches that "respiratory motion information can be extracted *directly* from the MR data" without the need for sensors. *Id.* at paragraph 14. Advantageously, with regard to one embodiment, the Larson reference specifically states that "timing signals can be derived from fetal MR data to *avoid the complexity of measuring a fetal ECG*." *Id.* at paragraph 15.

Therefore, although the Examiner is correct in stating that interference between electric sensors and magnetic fields generated by MR imaging systems is an undesirable problem in the prior art, the solution offered in the teachings of the Larson reference would clearly obviate the need to substitute the ECG with a non-electrical sensor and thus, one skilled in the art would not find it obvious nor necessary to combine the two references in the manner proposed by the Examiner in solving the problem addressed by Larson. Indeed, contrary to the Examiner's assertions, there is nothing in the Larson reference which would appear to suggest that non-electrical sensors would be desirable in place of or in conjunction with electrical sensors. That is, the Larson reference aims to remove the complexity of dealing with sensors while performing image acquisition. Adding non-electrical sensors in place of or in conjunction with electrical sensors *does not* remove the complexity involved in acquiring motion and image data concurrently, as noted via Larson, but may in fact exacerbate it.

Instead, Applicants assert that the Examiner's proposed combination is based on impermissible hindsight reconstruction, in which the Examiner has simply picked and chosen from isolated disclosures in the prior art to deprecate the claimed invention. *In re Fine*, 837 F.2d 1071, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988). Accordingly, Applicants respectfully traverse the Examiner's proposed combination of Larson and Rogers with regard to this subject matter and believe that no *prima facie* case of obviousness has been established.

Claims 25-32

Independent claims 25-32 are directed towards various methods and systems, as well as computer readable media storing a computer program, all of which reflect various embodiments of the present invention. Applicants note, however, that claims 25-32 each commonly recite the acquisition of *image data* via an MRI system, a PET system, a nuclear imaging system, an X-ray system a PET-CT system, or an ultrasound system concurrently with the acquisition of *motion data* for a heart from at least one *electrical*

sensor and at least one *non-electrical* sensor. Applicants respectfully submit that the Larson and Rogers references, alone or in combination, do not appear to teach or suggest this feature.

As discussed above, the Larson reference does disclose an MR imager and the use of an electrical sensor (e.g., ECG) to acquire cardiac (e.g., heart) data. However, the Larson reference fails to *also* disclose the concurrent acquisition of cardiac data using *non-electrical* sensors as well. To remedy this deficiency, the Examiner again relies on the Rogers reference for the teaching of non-electrical sensors for acquiring cardiac motion data. As discussed above, however, the Examiner's combination of Larson reference with the Rogers reference appears to be based on impermissible hindsight, as the technique of deriving motion data *directly* from MR imaging data would clearly obviate the need for additional sensors, either in conjunction with or in place of an ECG. Thus, for the same reasons discussed above with regard to independent claims 17-24, Applicants respectfully traverse the Examiner's hindsight combination of Larson and Rogers with regard to this subject matter and believe that no *prima facie* case of obviousness has been established.

Additional Features Common to Claims 9-32 Omitted from the Cited References

Although Applicants believe that the Examiner's Section 103 rejections of the claim groups 9-16, 17-24, and 25-32 are deficient for at least the specific reasons set forth above, Applicants further submit that the Larson and Rogers references, alone or in combination, fail to teach or suggest several additional features commonly recited in all of these claims. Specifically, Applicants note that each of these claims recites the extraction of two or more *retrospective gating points* and one or more *motion compensation factors* from the recited *motion data acquired via sensors*.

Extracting Retrospective Gating Points from the Motion Data Acquired via Sensors

As discussed above with regard to independent claims 1-8, the Examiner appears to have correlated the timing information extracted *directly* from MR image data, as taught by Larson, to the recited "two or more retrospective gating points." For instance, with regard to one particular embodiment disclosed by Larson, the timing information may be extracted from the analysis of k-space image data itself. However, the k-space image data is clearly acquired via an imager, *not* a sensor. Therefore, the extraction of the timing information, which it appears the Examiner has equated with retrospective gating points, could not be reasonably construed as being extracted from *motion data acquired via sensors*, as would be required to anticipate or render obvious claims 9-32. Further, the Rogers reference, upon which the Examiner has relied on for the teaching of non-electric sensors alone, does not appear to cure this deficiency. As such, Applicants do not believe that the Larson or Rogers references, taken alone or in combination, can render obvious claims 9-32 with regard to this subject matter.

Motion Compensation Factors

As discussed above, the Larson reference also does not appear to discuss extracting *motion compensation factors* from motion data acquired via sensors. The Larson reference is generally directed towards the *direct extraction* of motion data via analyzing MR image data, thus obviating the need for acquiring motion data via sensors. Based on the analysis of the MR image data, timing information, which the Examiner has correlated with retrospective gating points, may be extracted. The Larson reference further discloses that the peak, phase, and rate information may be extracted from the timing information to align the image data with the motion of the target organ of interest.

As discussed above, the Examiner alleged that the extracted peak, phase and rate information, as taught by Larson, constitutes the recited motion compensation factors. However, for the reasons discussed above with regard to claims 1-8, Applicants do not agree that such peak, phase, and rate information constitutes motion compensation factors

For instance, the specification of the present application defines motion compensation factors as data predicting future motion by modeling anticipated motion, either iteratively or non-iteratively, based on the acquired motion data or based on known a priori data about a moving organ. This definition does not appear to be consistent with the Larson reference, which appears to merely suggest that the peak, phase, and rate information may be used to temporally align the image data with the motion of the organ, but does not appear to discuss motion compensation. *See* Larson, paragraphs 18-19.

However, even assuming that the peaks, phases, and rate of the time-varying signal information could be considered as motion compensation factors, claims 9-32 would further require that these alleged motion compensation factors are extracted from the *motion data which is acquired via sensors*. Specifically, claims 1-8 recite extracting one or more motion compensation factors *from* the motion data acquired via the recited sensors, and processing image data based upon extracted motion compensation factors. In stark contrast, the Larson reference makes it clear that this information is extracted *from the timing information* which is extracted from the *image data* acquired via the MR imager. Thus, contrary to the Examiner's assertions, these peaks, phase, and rate of change information are ultimately derived from the *image data* acquired via the MR imager of Larson, not from *sensor* acquired *motion data*. The Rogers reference, upon which the Examiner has relied on for the teaching of non-electric sensors, does not appear to cure this deficiency. As such, Applicants do not believe that the Larson or Rogers references, taken alone or in combination, can render obvious claims 9-32 with regard to this subject matter.

In view of the numerous deficiencies described above, among others, Applicants believe that no combination of the Larson or Rogers references can properly establish a *prima facie* case of obviousness with regard to independent claims 9-32. As such, Applicants respectfully request withdrawal of the rejection under Section 103 and allowance of claims 9-32.

Conclusion

In view of the remarks and amendments set forth above, Applicants respectfully request allowance of the pending claims. If the Examiner believes that a telephonic interview will help speed this application toward issuance, the Examiner is invited to contact the undersigned at the telephone number listed below.

Respectfully submitted,

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/John Rariden/

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